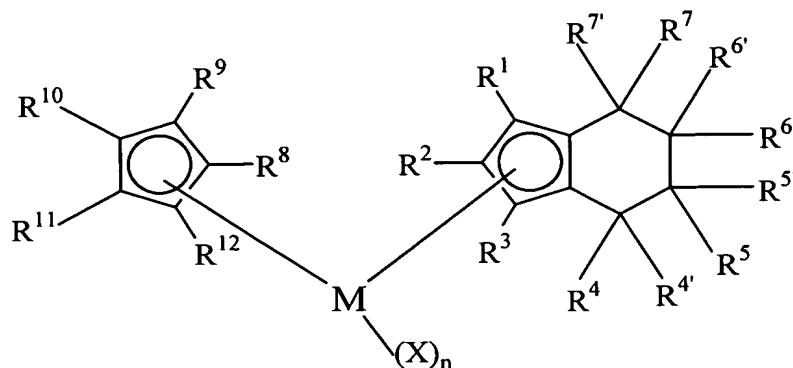


CLAIMS

What is claimed is:

1. A method of producing polyethylene, the method comprising:
combining ethylene and at least one α -olefin selected from C_3 to C_{10} α -olefins, an
activator, and a metallocene catalyst compound to produce a polyethylene;
wherein the metallocene catalyst compound is selected from:



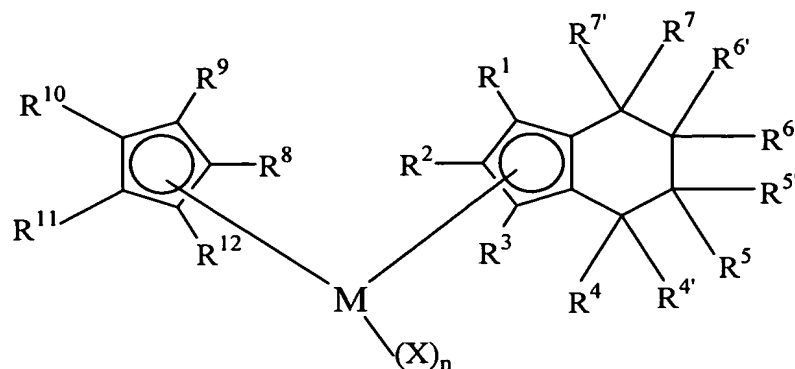
wherein M is a Group 4 atom; X is a leaving group; n is an integer from 0 to 3; and

R¹ to R¹² are independently selected from the group consisting of hydrides, halogens, hydroxy, C₁ to C₆ alkoxys, C₁ to C₆ alkenyls, and C₁ to C₁₀ alkyls; and

characterized in that when the comonomer is 1-hexene, and the mole ratio of 1-hexene to ethylene combined is varied between 0.015 to 0.05, the density of the resultant polyethylene changes by less than 5 % and the I₂₁/I₂ varies from 10 to 150.

2. The method of Claim 1, further characterized in that the I₂₁/I₂ of the polyethylene varies from 15 to 100.
3. The method of Claim 1, wherein R¹ to R¹² are groups selected from the group consisting of hydride and C₁ to C₁₀ alkyls.
4. The method of Claim 1, wherein R¹ to R¹² are groups selected from the group consisting of hydride and C₁ to C₅ alkyls.

5. The method of Claim 1, wherein R^1 to R^4 and R^7 to R^{12} are groups selected from the group consisting of hydride and C_1 to C_{10} alkyls, and R^5 , $R^{5'}$, R^6 , and $R^{6'}$ groups are hydride.
6. The method of Claim 1, wherein the combining takes place under gas-phase polymerization conditions.
7. The method of Claim 1, characterized in that when the mole ratio of 1-hexene to ethylene combined is varied from 0.02 to 0.05, the density of the resultant polyethylene changes by from less than 2 %.
8. The method of Claim 1, further characterized in that when the mole ratio of 1-hexene to ethylene combined is varied from 0.02 to 0.05 the amount of methyl groups per 1000 carbon atoms of the polyethylene produced therein is from less than 20.
9. The method of Claim 1, further characterized in that when the mole ratio of 1-hexene to ethylene combined is varied from 0.02 to 0.05 the amount of comonomer incorporated into the polyethylene produced therein ranges from less than 12 wt% of the total weight of the polyethylene.
10. The method of Claim 1, wherein the activator and metallocene catalyst compound are supported on a carrier material.
11. A polyethylene produced by the method of any one of Claims 1 through 10 having an I_2/I_1 value of from 10 to 300, an M_w/M_n of 1.9 to 6, and a density of from 0.88 to 0.97 g/cm³.
12. A catalyst system comprising:
an activator and a metallocene catalyst compound; wherein the metallocene catalyst compound is selected from:



wherein M is a Group 4 atom; X is a leaving group; n is an integer from 0 to 3; and

R^1 to R^{12} are independently selected from hydrides, halogens, hydroxy, C_1 to C_6 alkoxys, C_1 to C_6 alkenyls, and C_1 to C_{10} alkyls; and

characterized in that when one or more metallocenes and an activator are combined with ethylene and 1-hexene, and the mole ratio of 1-hexene to ethylene combined is varied between 0.015 to 0.05, the density of the resultant polyethylene changes by less than 5 % and the I_{21}/I_2 varies from 10 to 150.

13. The catalyst system of Claim 12, further characterized in that the I_{21}/I_2 of the polyethylene varies from 15 to 100.
14. The catalyst system of Claim 12, wherein R^1 to R^{12} are groups selected from the group consisting of hydride and C_1 to C_{10} alkyls.
15. The catalyst system of Claim 12, wherein R^1 to R^{12} are groups selected from the group consisting of hydride and C_1 to C_5 alkyls.
16. The catalyst system of Claim 12, wherein R^1 to R^{12} are groups selected from the group consisting of hydride and C_1 to C_3 linear alkyls.
17. The catalyst system of Claim 12, wherein R^1 to R^4 and R^7 to R^{12} are groups selected from the group consisting of hydride and C_1 to C_{10} alkyls, and R^5 , R^5' , R^6 , and R^6' groups are hydride.

18. The catalyst system of Claim 12, wherein the density of the resultant polyethylene changes by less than 2 %.
19. The catalyst system of Claim 12, further comprising a carrier, wherein the activator and metallocene catalyst compound are supported on the carrier.
20. The catalyst system of Claim 12, characterized in that when the mole ratio of 1-hexene to ethylene combined is varied from 0.02 to 0.05, the density of the resultant polyethylene changes by from less than 2 %.
21. The catalyst system of Claim 12, further characterized in that when the mole ratio of 1-hexene to ethylene combined is varied from 0.02 to 0.05 the amount of methyl groups per 1000 carbon atoms of the polyethylene produced therein is from less than 20.
22. The catalyst system of Claim 12, further characterized in that when the mole ratio of 1-hexene to ethylene combined is varied from 0.02 to 0.05 the amount of comonomer incorporated into the polyethylene produced therein ranges from less than 12 wt% of the total weight of the polyethylene.